US007431608B2

(12) **United States Patent**
Sakaguchi et al.

(10) **Patent No.: US 7,431,608 B2**
(45) **Date of Patent: Oct. 7, 2008**

(54) **SHIELDED CABLE CONNECTING STRUCTURE**

(75) Inventors: **Tadahisa Sakaguchi**, Makinohara (JP); **Takayoshi Endo**, Makinohara (JP)

(73) Assignee: **Yazaki Corporation**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **11/706,998**

(22) Filed: **Feb. 16, 2007**

(65) **Prior Publication Data**

US 2007/0197097 A1 Aug. 23, 2007

(30) **Foreign Application Priority Data**

Feb. 20, 2006 (JP) 2006-042734

(51) **Int. Cl.**
H01R 4/24 (2006.01)

(52) **U.S. Cl.** **439/394**

(58) **Field of Classification Search** 439/99, 439/98, 610, 394, 398; 174/78
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,416,501 A * 11/1983 Fusselman et al. 439/396
6,951,483 B2 * 10/2005 Kameyama 439/595

FOREIGN PATENT DOCUMENTS

JP 08-340615 A 12/1996

* cited by examiner

Primary Examiner—Phuong K Dinh
(74) *Attorney, Agent, or Firm*—Sughrue Mion, PLLC

(57) **ABSTRACT**

A shielded cable connecting structure for connecting a shielded cable, the shielded cable including an electric wire portion which has a conductor and an inner sheath covering the conductor, a braided wire braided around the inner sheath, and an outer sheath covering the braided wire, the shielded cable connecting structure includes a connecting member. The connecting member includes a connecting main body, a press-fastening portion which press-fastens at least part of the shielded cable, a connecting portion which connects to the braided wire, and a spacer which connects to the braided wire. The spacer increases a contact pressure of the braided wire with the connecting portion.

6 Claims, 11 Drawing Sheets

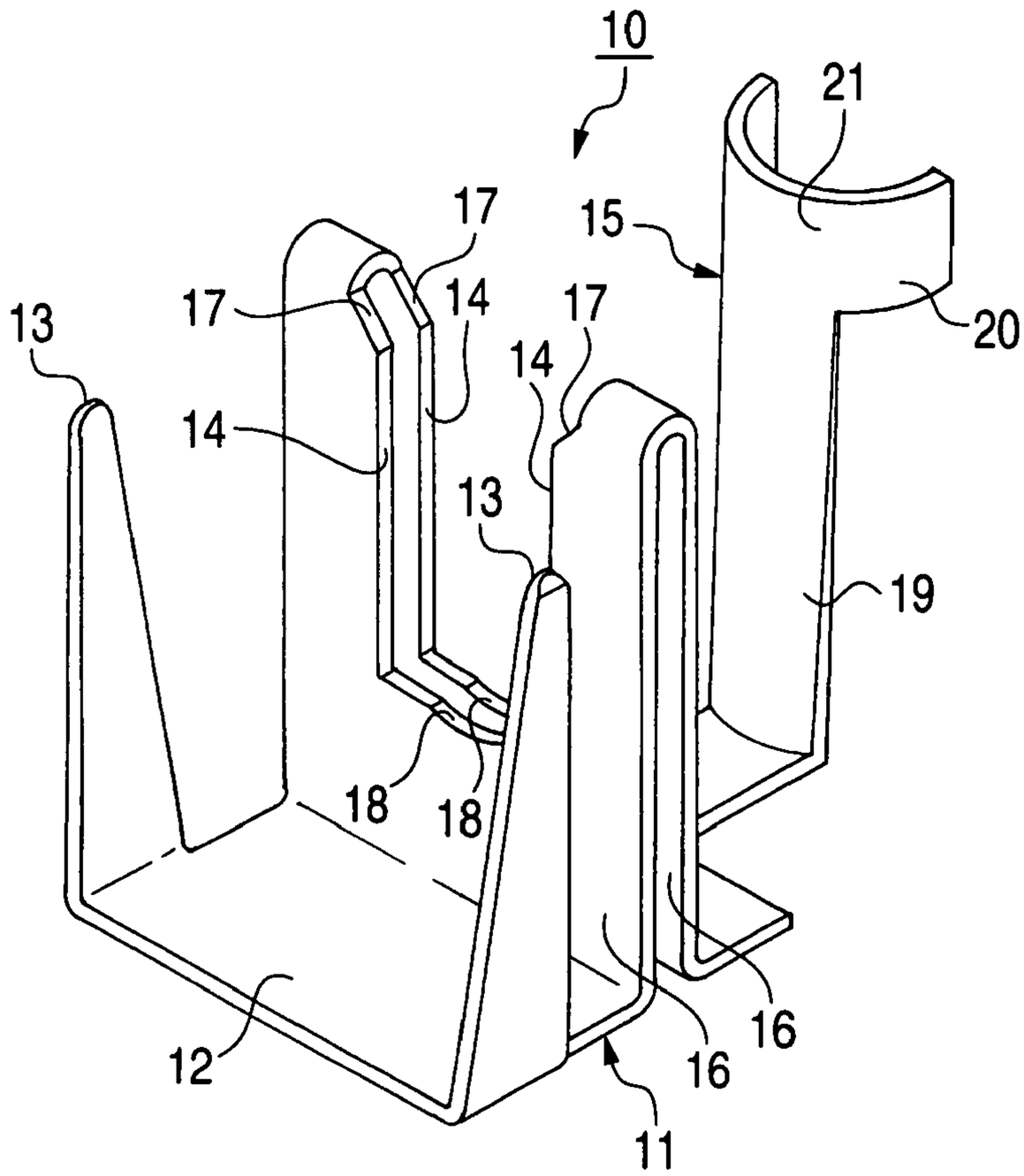


FIG. 1

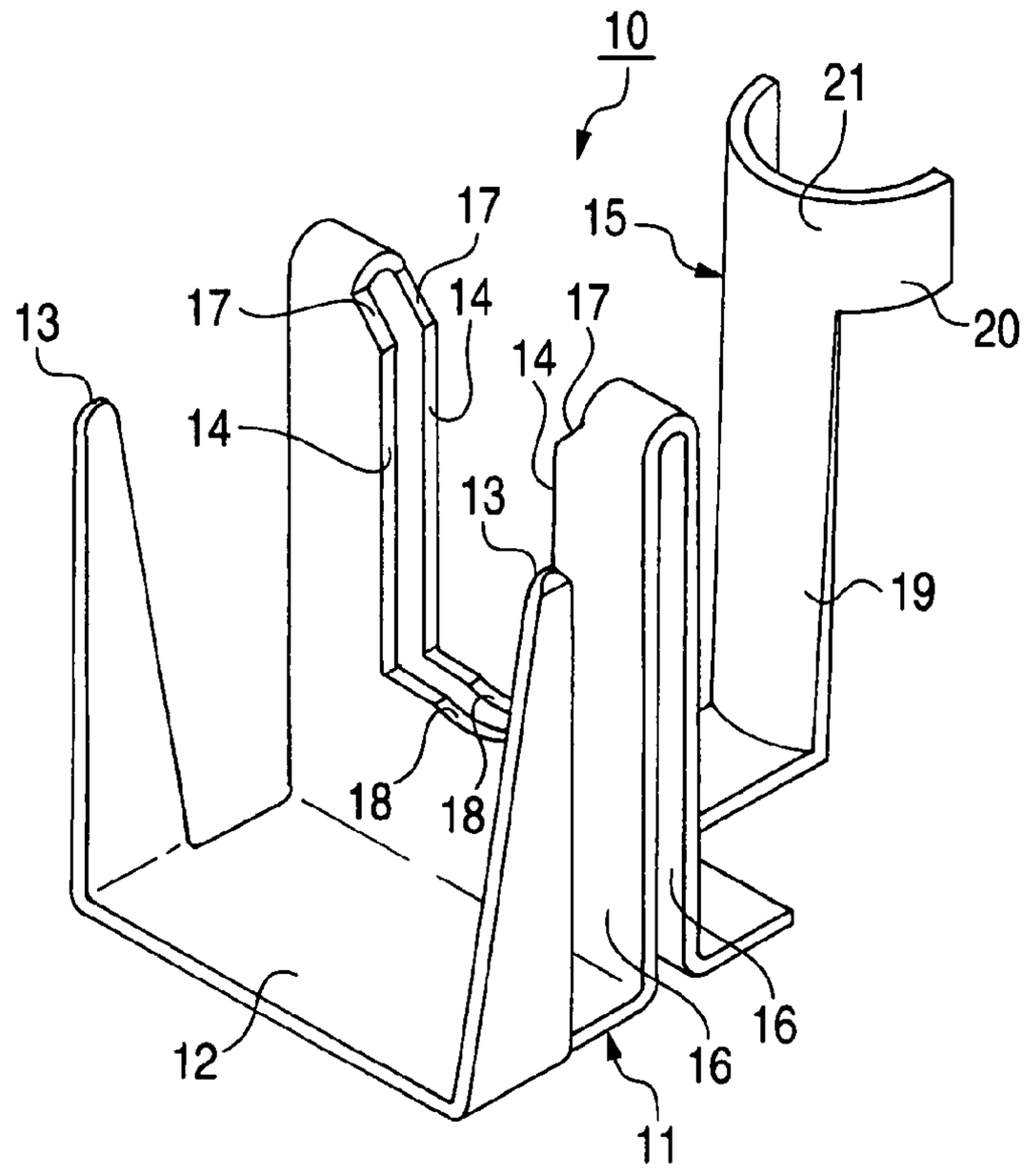

10
21
15
17
17
14
17
14
20
13
14
13
19
18
18
16
16
12
11

FIG. 2

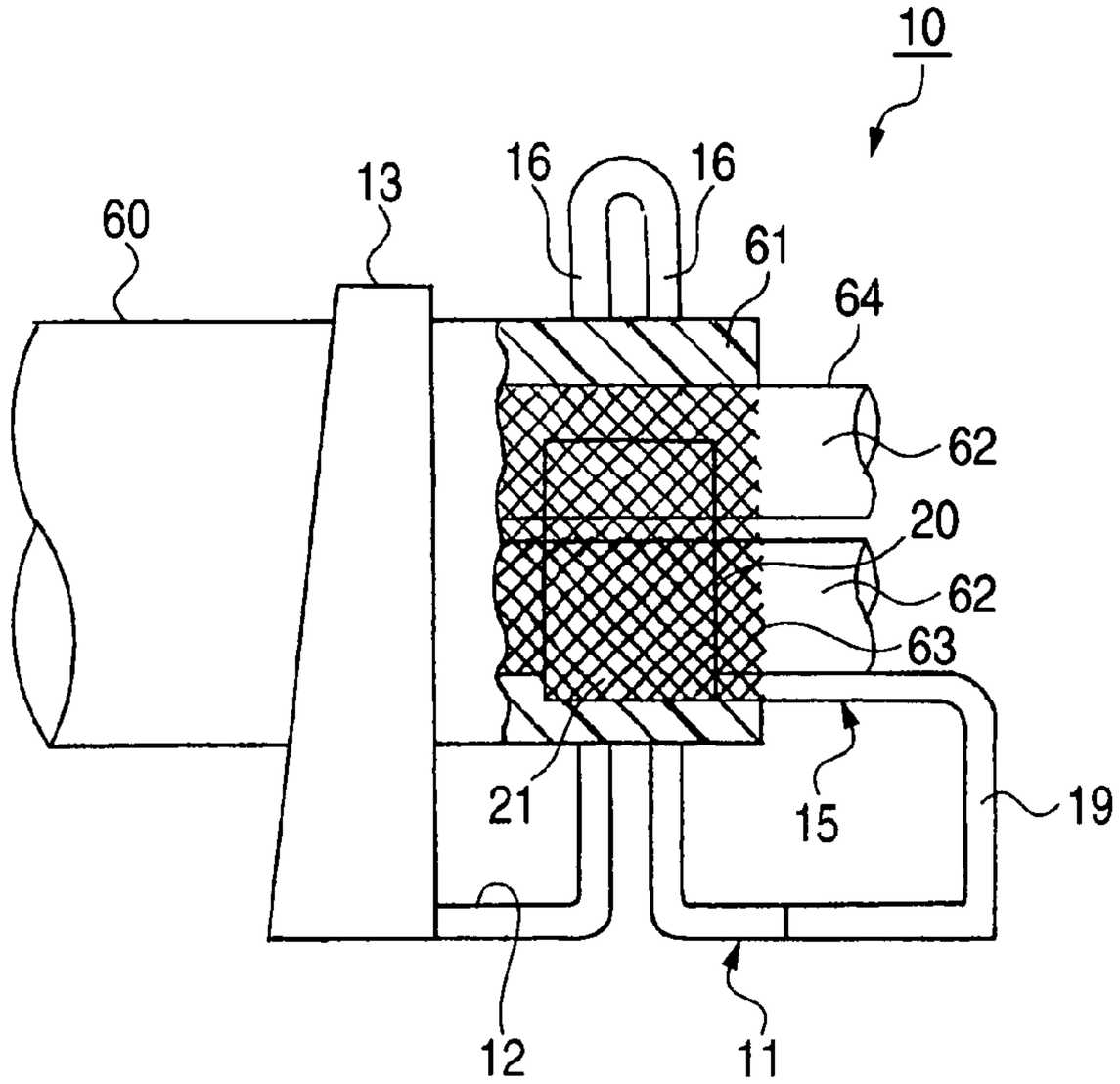

10
16
16
13
60
61
64
62
20
62
63
21
15
19
12
11

FIG. 3

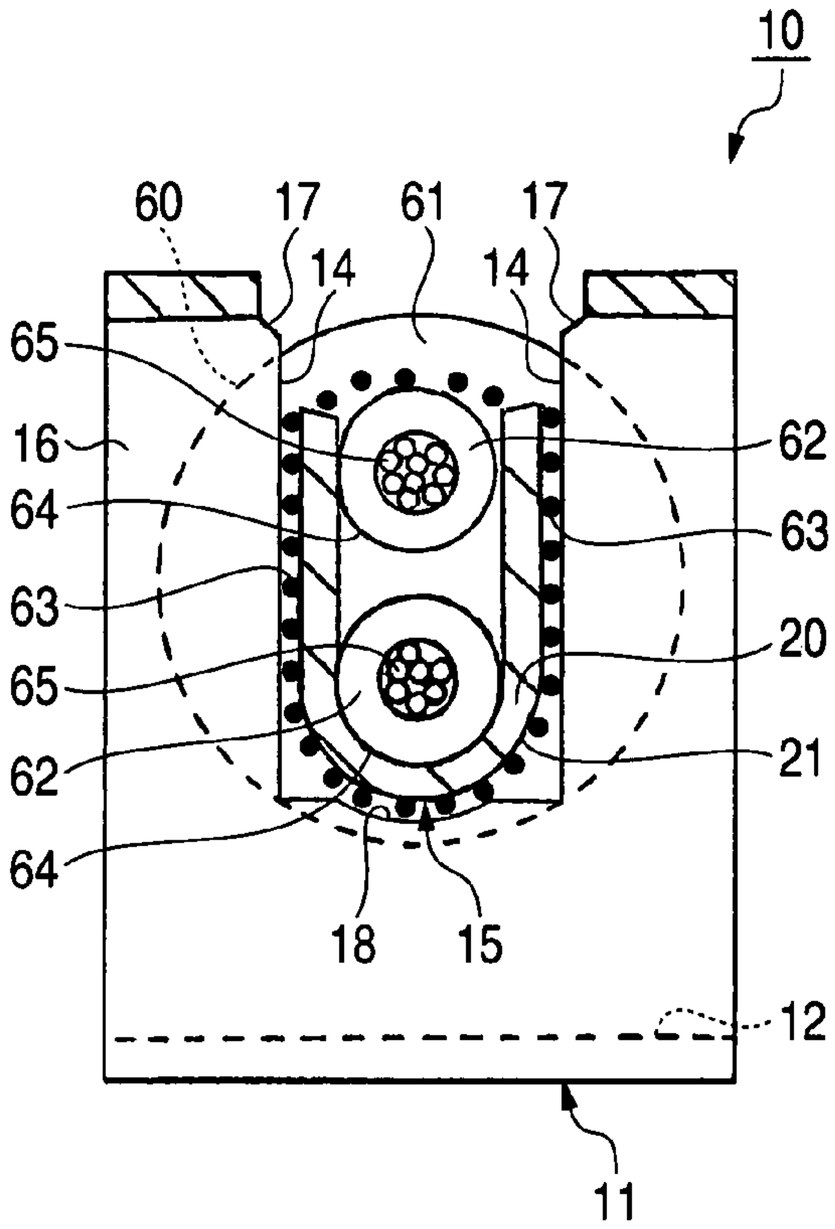

10
60
17
61
17
14
14
65
16
64
63
65
62
64
62
63
20
21
18
15
12
11

FIG. 4

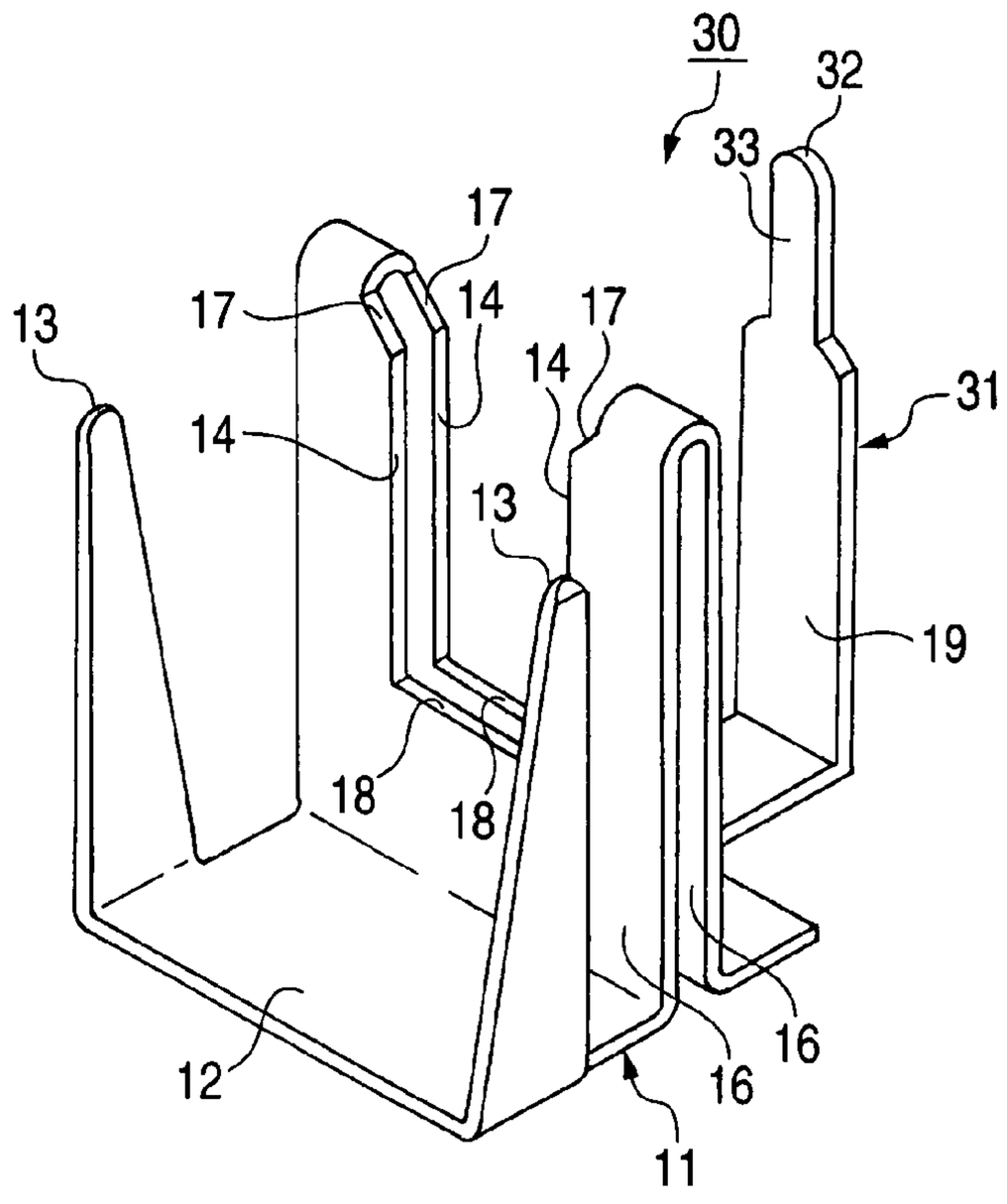

30
32
33
17
17
14
17
14
13
14
14
13
31
19
18
18
12
16
16
11

FIG. 5

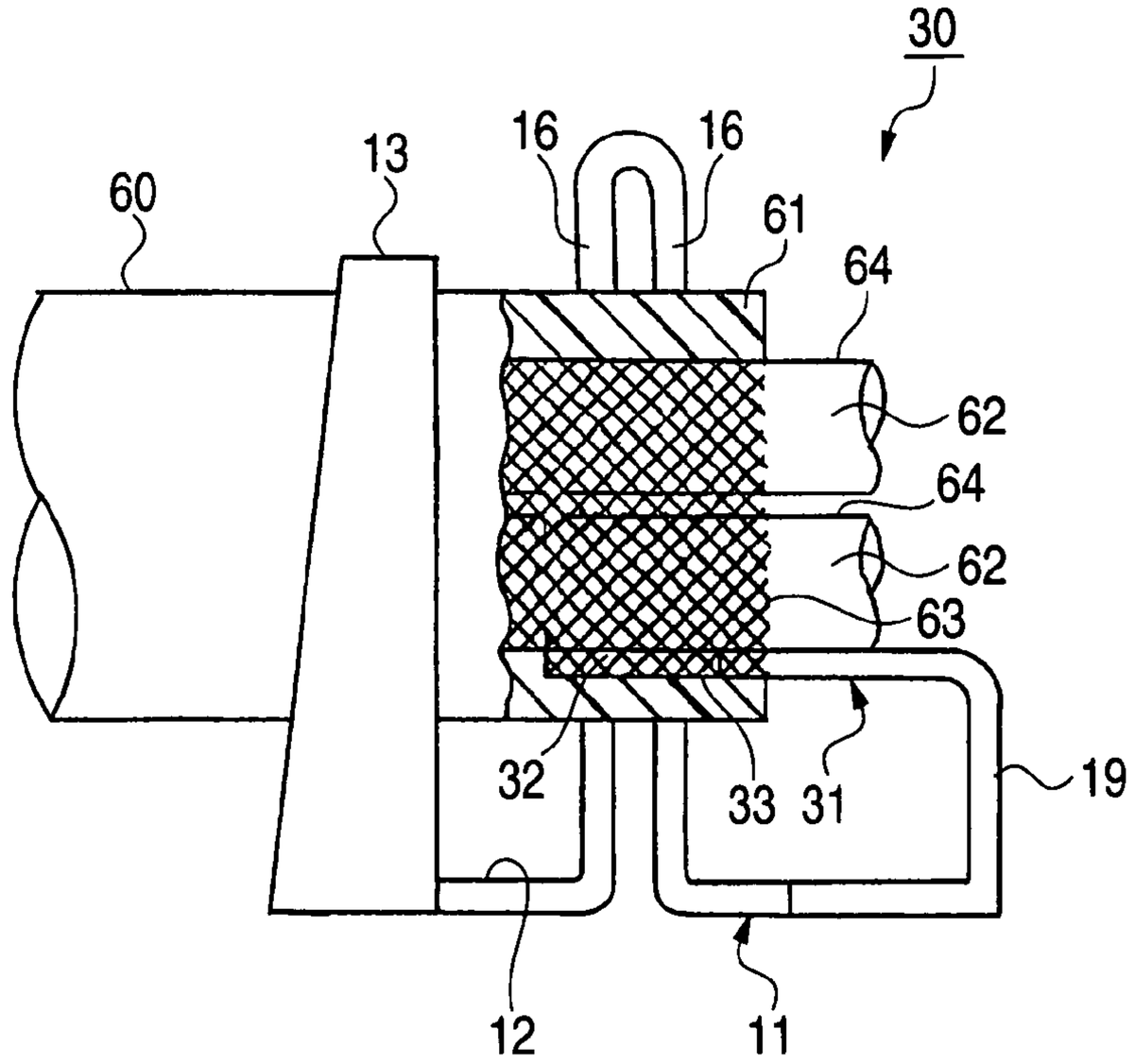

30
16
16
13
60
61
64
62
64
62
63
32
33
31
19
12
11

FIG. 6

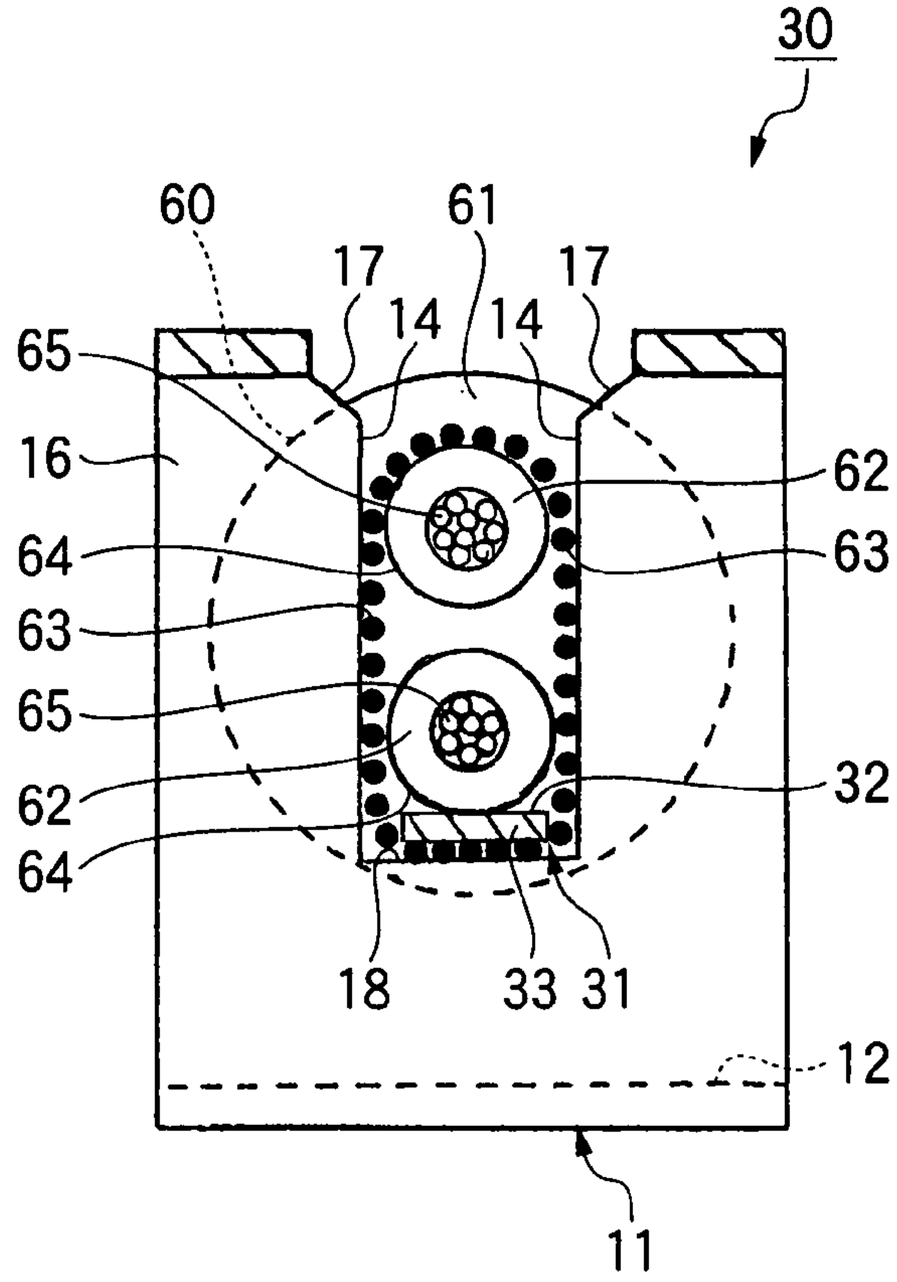

30
60
61
17
17
14
14
65
16
62
64
63
63
65
62
64
32
18
33
31
12
11

FIG. 7

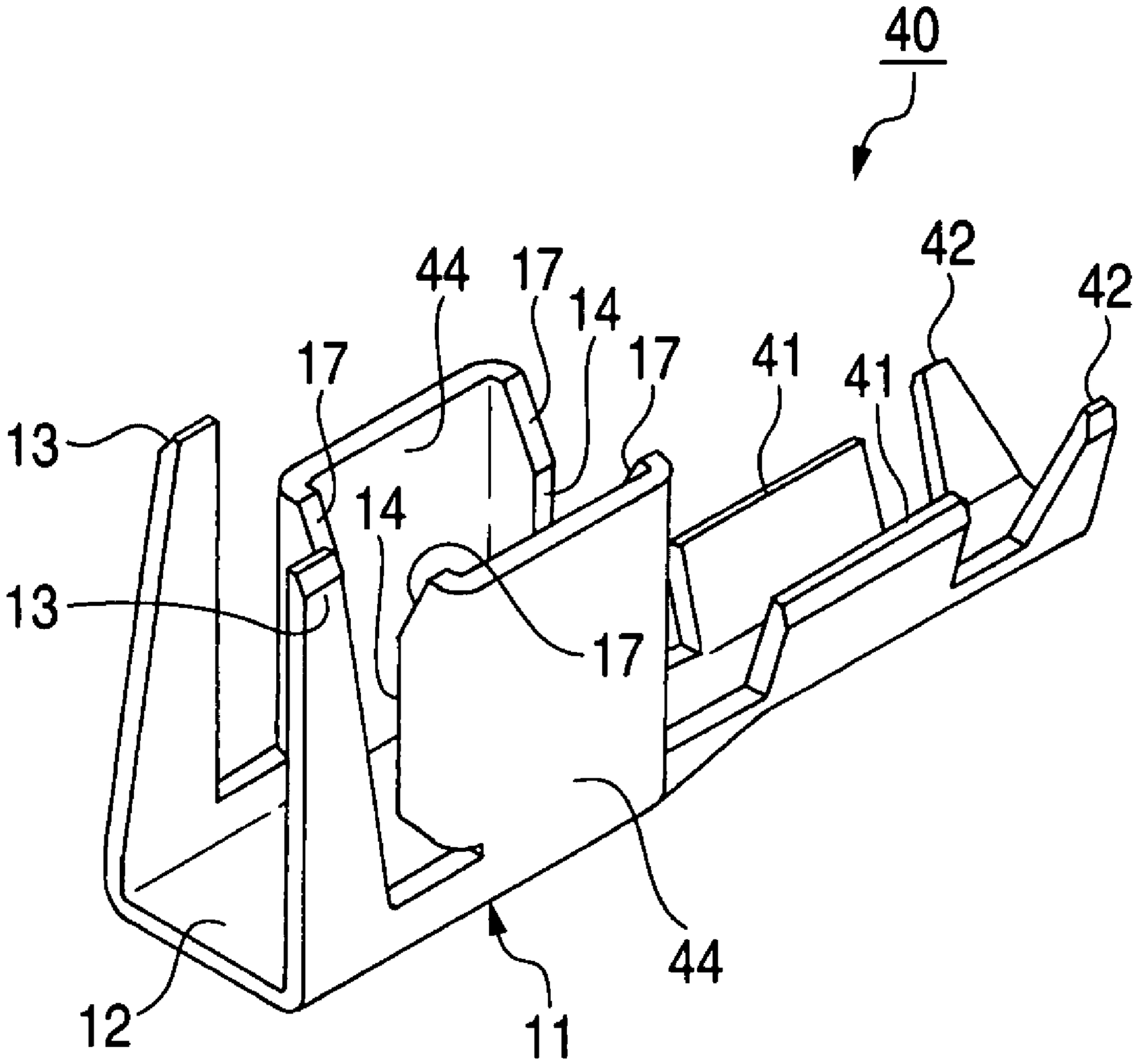


FIG. 8

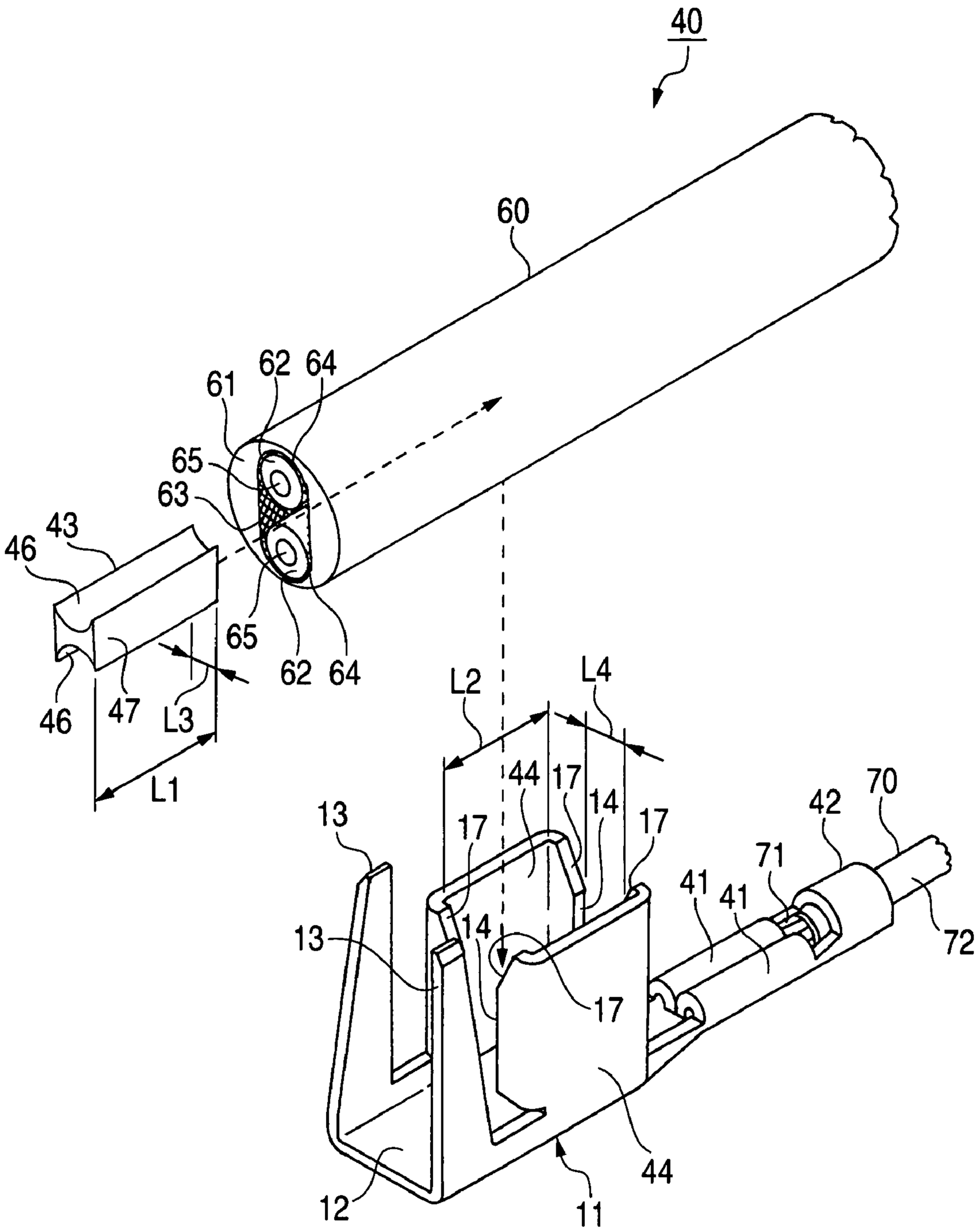

40
60
61
62
64
65
63
43
46
65
62
64
46
47
L3
L1
L2
L4
44
17
14
17
13
17
42
70
71
41
41
72
13
14
17
12
11
44

FIG. 9

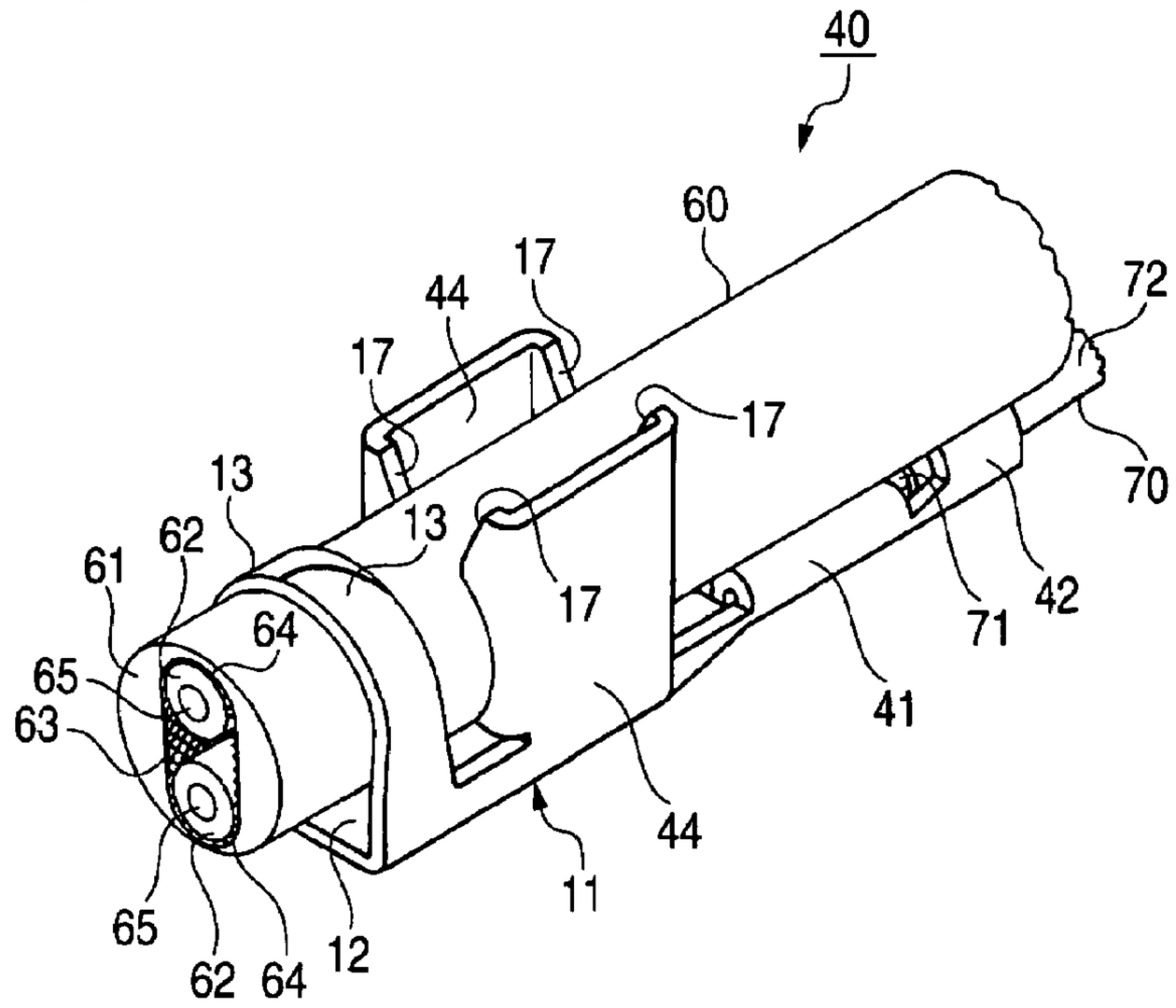

40
60
17
44
17
72
17
13
13
62
61
64
65
63
17
71
42
70
41
44
11
65
62
64
12

FIG. 10

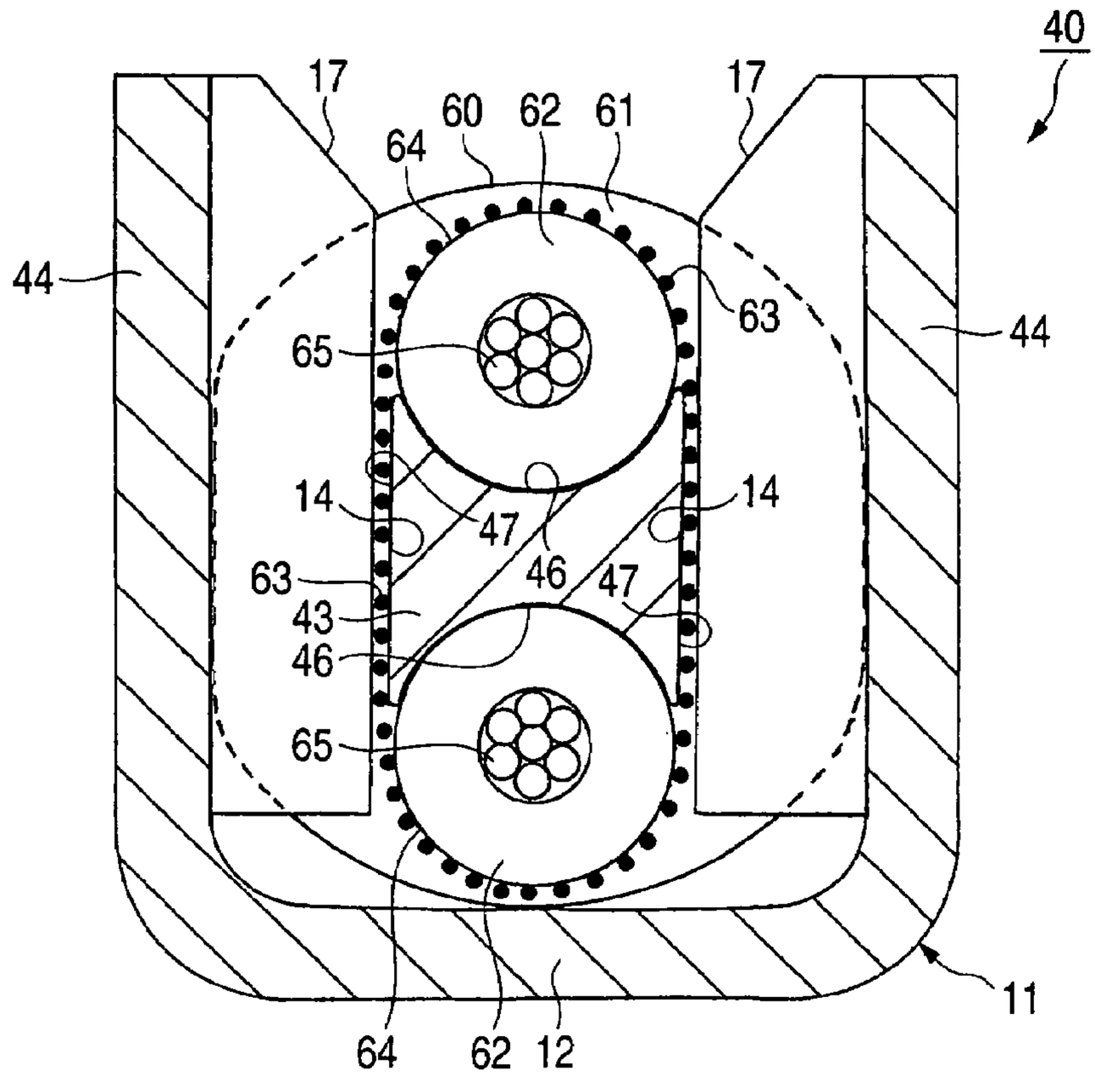

40
17
60
62
61
17
64
44
63
65
44
14
14
47
63
46
47
43
46
65
11
64
62
12

FIG. 11

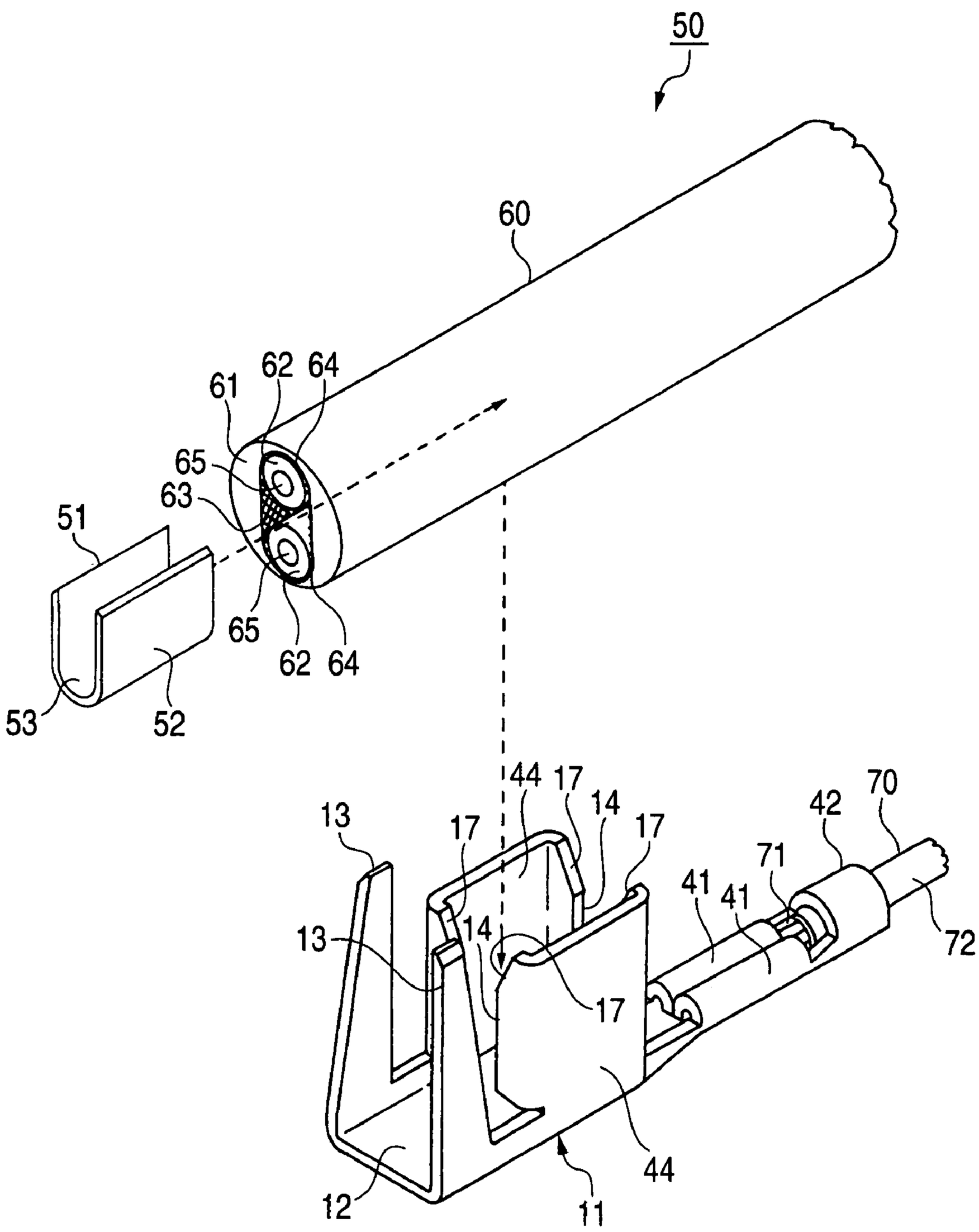

50
60
61
62
64
65
63
51
65
62
64
53
52
44
17
14
17
17
42
70
71
41
41
72
13
13
14
17
12
11
44

FIG. 12

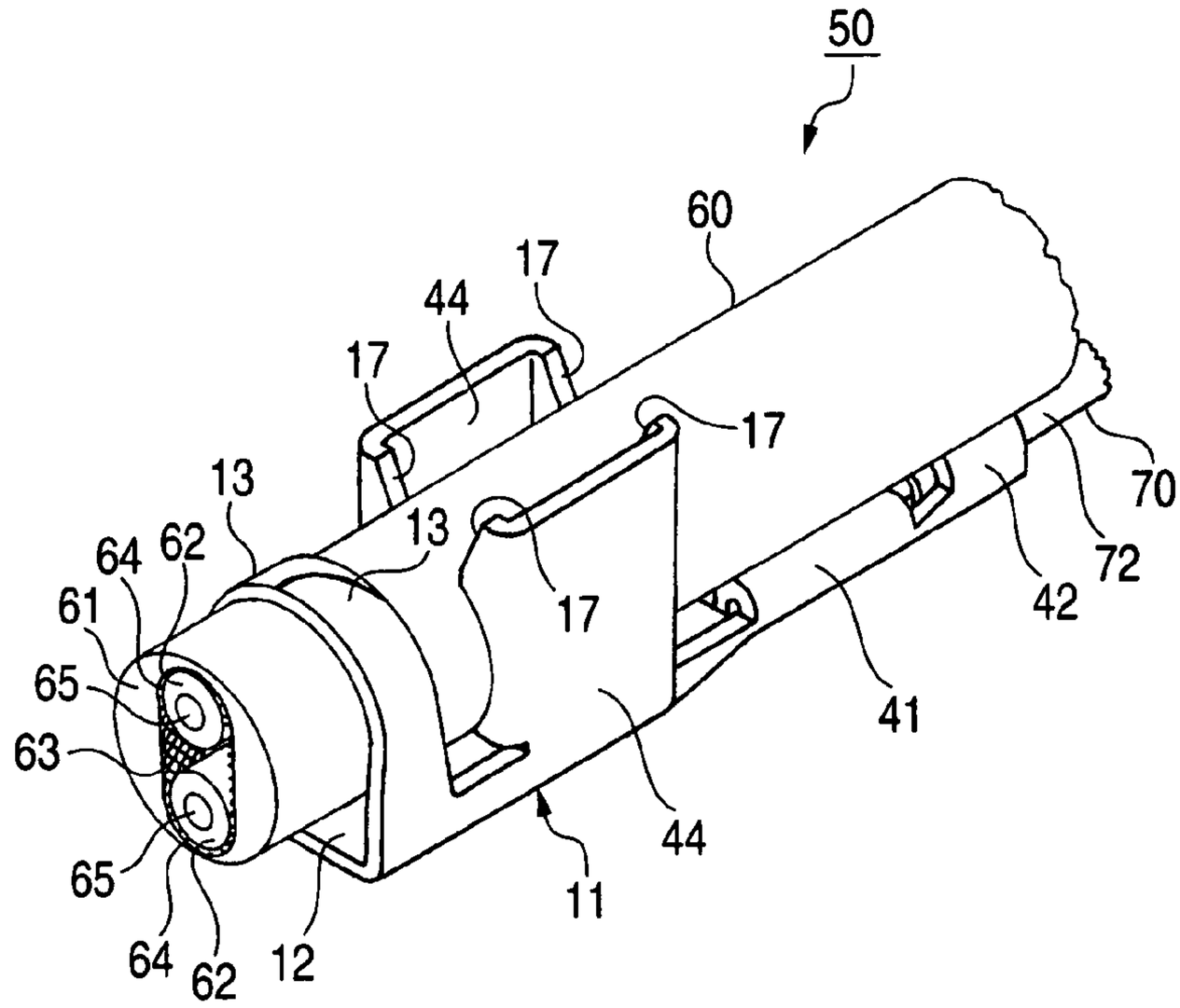

50
60
17
44
17
17
13
13
64
62
61
65
63
65
64
62
12
11
44
41
42
72
70

FIG. 13

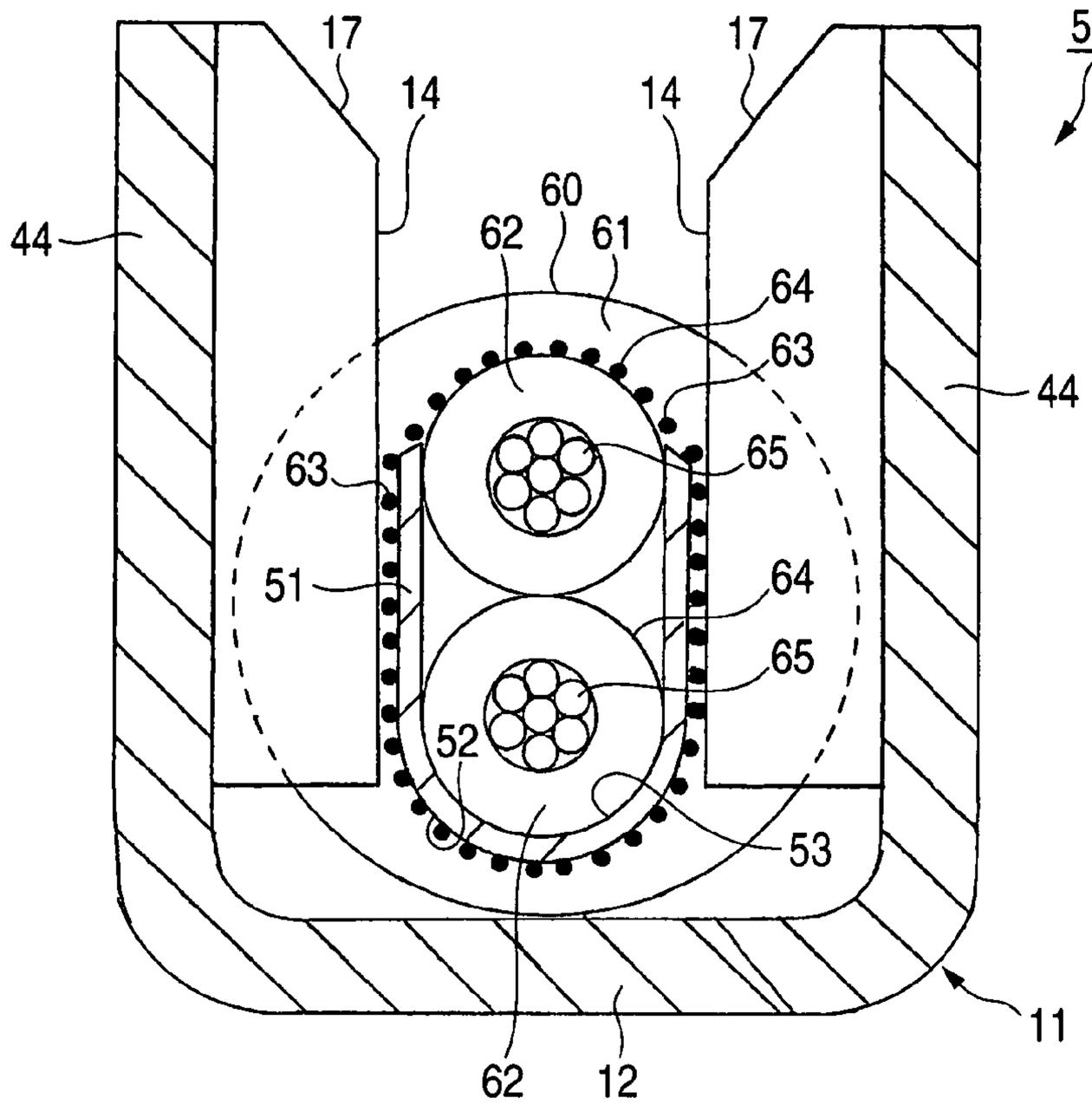

17
14
17
14
50
44
60
62
61
64
63
65
63
51
64
65
52
53
44
11
62
12

FIG. 14

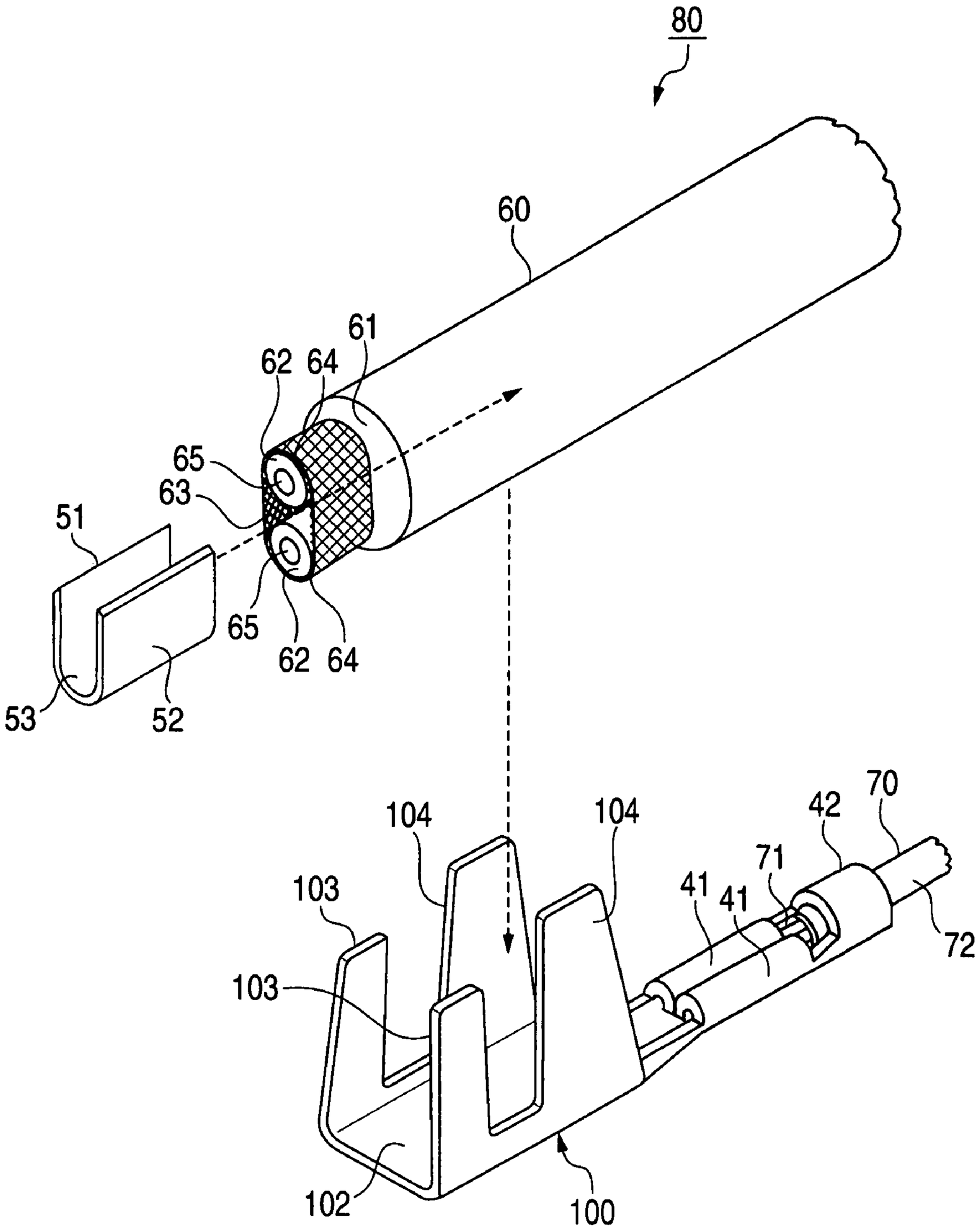

80
60
61
62
64
65
63
51
65
62
64
53
52
104
104
103
103
102
100
41
41
71
42
70
72

FIG. 15

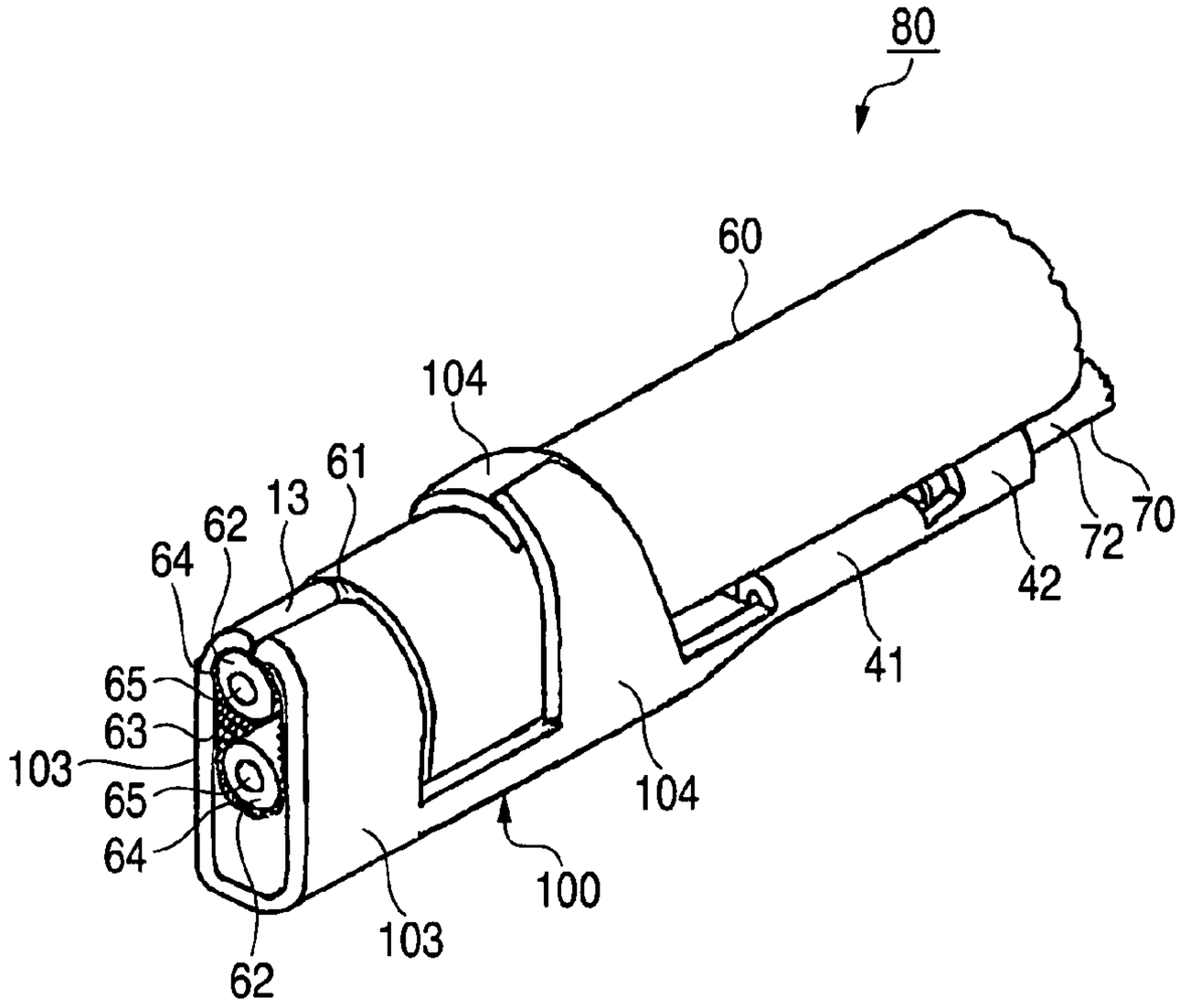

80
60
104
61
13
62
64
65
63
103
65
64
62
103
100
104
41
42
72
70

FIG. 16

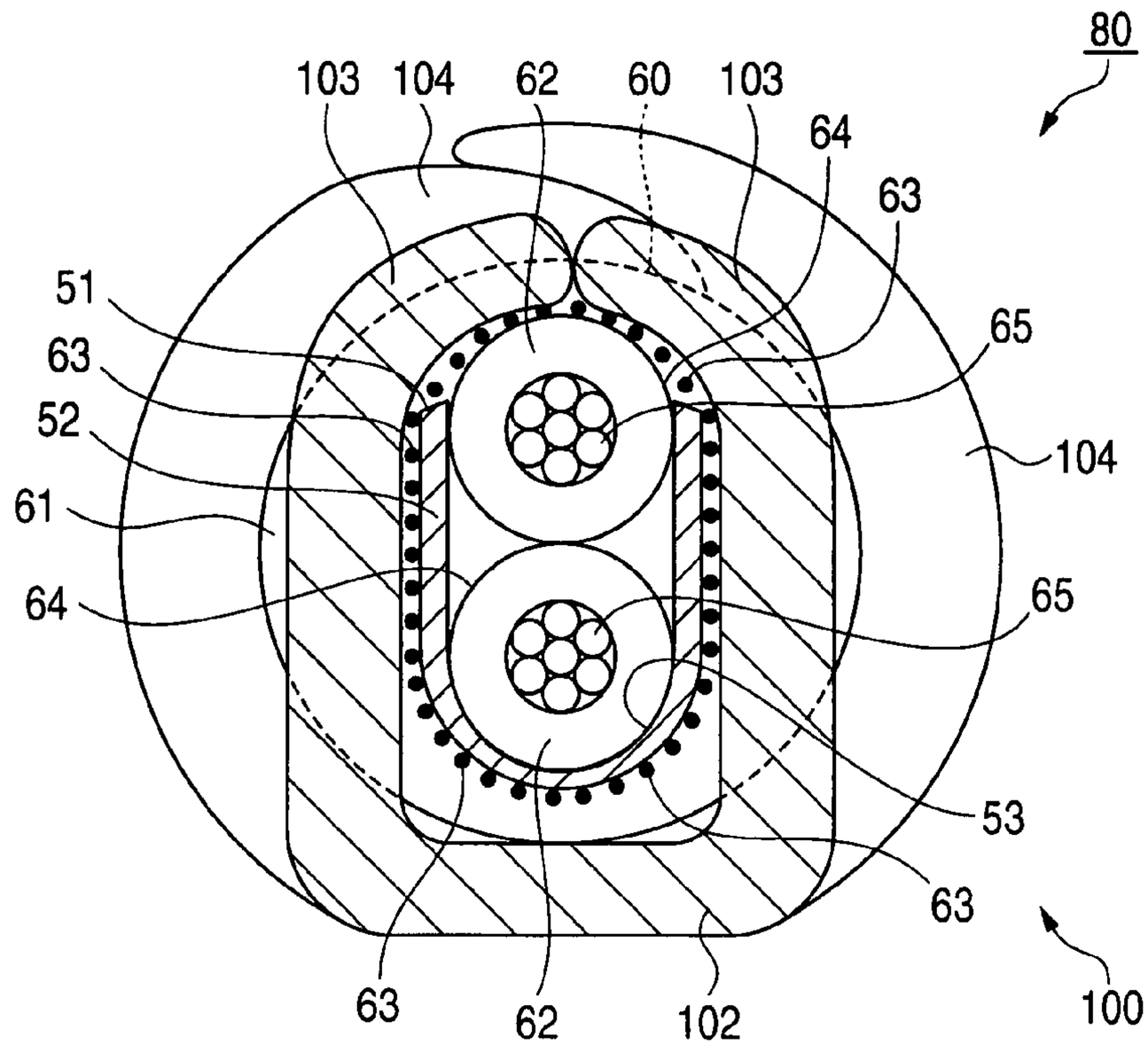
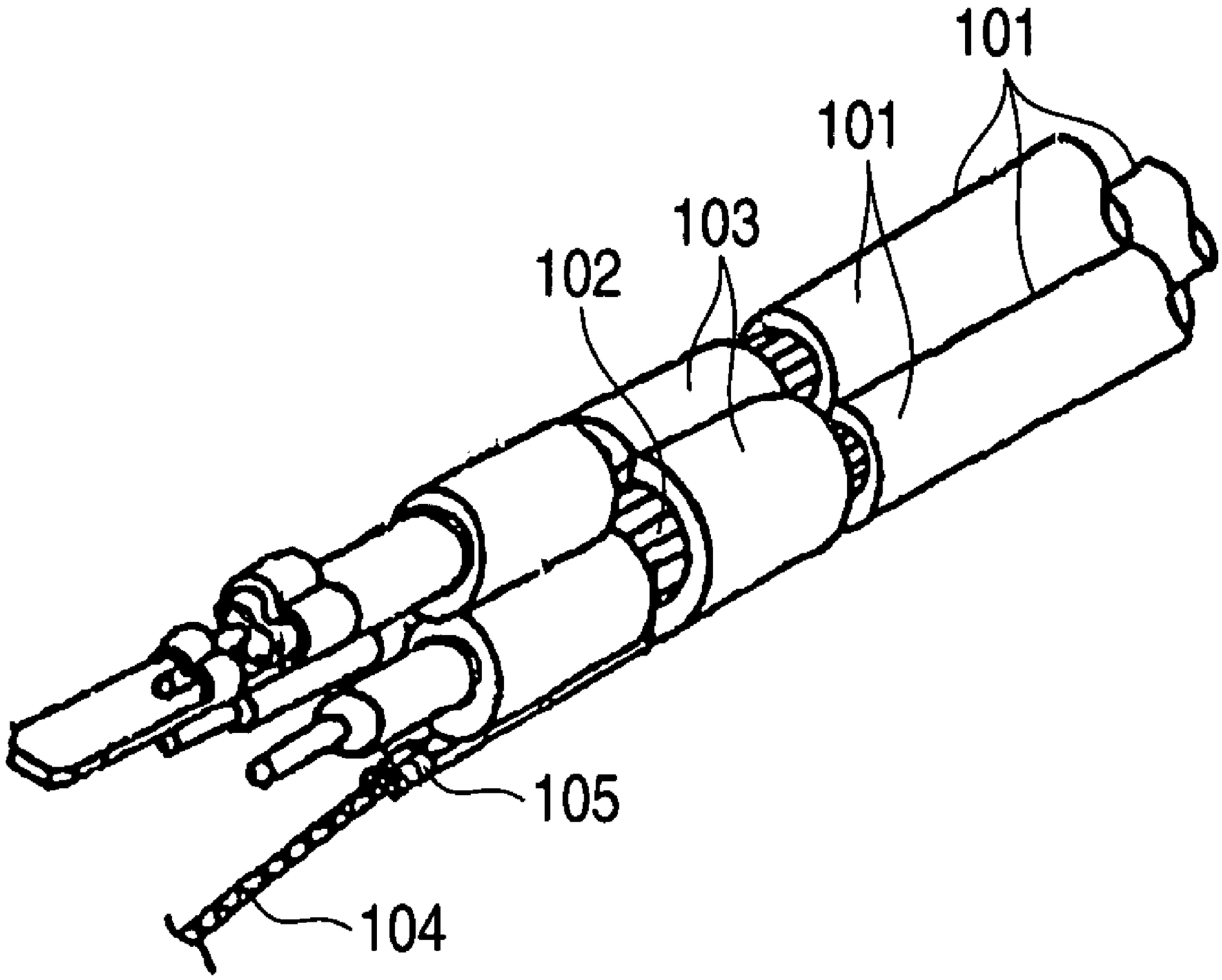

80
103
104
62
60
103
64
63
51
63
52
61
64
65
104
65
53
63
63
62
102
100

FIG. 17



SHIELDED CABLE CONNECTING STRUCTURE

BACKGROUND OF THE INVENTION

This invention relates to a shielded cable connecting structure used for connecting a braided wire incorporated in a shielded cable.

There is known a related shielded cable connecting structure in which insulating sheaths of shielded cables are removed to thereby expose respective braided wires, and these braided wires are twisted, and then are press-fastened by barrels (see, for example, JP-A-8-340615 (FIG. **1**)).

In the shielded cable connecting structure disclosed in JP-A-8-340615, the insulating sheaths **101** of the shielded cables **100** are removed to thereby expose the braided wires **102**, and these braided wires **102** are gathered together, and then the shielded cables are press-fastened together by barrels **103**, and the braided wires are press-fastened to a drain wire **104** by barrels **105** spaced apart from the barrels **103**, as shown in FIG. **17**.

However, in the related shielded cable connecting structure disclosed in the JP-A-8-340615, the operation for gathering the exposed braided wires **102** together (that is, a so-called twisting operation) is difficult, and therefore the braided wires **102** (each composed of woven fine wires) become loose, depending on the degree of skill, so that the number of the fine wires decreases, or the capacity decreases. Thus, the efficiency of the operation is not good, and it is difficult to enhance the productivity by achieving the automated operation.

Generally, in order that a disturbance developing around a shielded cable will not intrude into a conductor when flowing a very small voltage signal or a very small current signal through the conductor, a grounded braided wire is provided around the conductor to cover the same so as to capture the disturbance, and the thus captured disturbance is positively flowed to a grounding circuit. Therefore, the capacity of the braided wire is determined in a condition in which the braided wire covers the conductor over the entire periphery thereof. Considering this with respect to the structure of JP-A-8-340615, the areas of non-shielded portions (where the conductor is not covered with the braided wire over the entire periphery thereof increase as a result of gathering the braided wires together, so that there is a fear that the reliability against the disturbance is not satisfactory.

SUMMARY OF THE INVENTION

This invention has been made in view of the above circumstances, and an object of the invention is to provide a shielded cable connecting structure in which a good operation efficiency can be achieved, and a connecting path of a braided wire can be positively secured.

1) According to one aspect of the present invention, there is provided a shielded cable connecting structure for connecting a shielded cable, the shielded cable including an electric wire portion which has a conductor and an inner sheath covering the conductor, a braided wire braided around the inner sheath, and an outer sheath covering the braided wire, the shielded cable connecting structure comprising:

a connecting member that includes:

a connecting main body;

a press-fastening portion which press-fastens at least part of the shielded cable;

a connecting portion which connects to the braided wire; and

a spacer which connects to the braided wire,

wherein the spacer increases a contact pressure of the braided wire with the connecting portion.

Preferably, the connecting portion is a press-contacting portion or a press-clamping portion.

In the invention of the above Paragraph 1), the braided wire of the shielded cable is connected to the press-contacting portion or the press-clamping portion, and the spacer connected to the braided wire is connected to the connecting member body, so that a connecting path of the braided wire is formed with a large current-carrying capacity. Therefore, the braided wire, while kept braided around the inner sheath, is electrically connected to the connecting member body without being gathered or twisted. Therefore, a good operation efficiency can be achieved, and the connecting path of the braided wire can be positively secured.

2) Preferably, the spacer is formed at a part of the connecting main body.

In the invention of the above Paragraph 2), the braided wire of the shielded cable is connected to the press-contacting portion or the press-clamping portion, and the spacer formed integrally with the connecting member body is connected to the braided wire, so that a connecting path of the braided wire is formed with a large current-carrying capacity. Therefore, the braided wire, while kept braided around the inner sheath, is electrically connected to the connecting member body without being gathered or twisted.

3) Preferably, the spacer is separate from the connecting main body.

In the invention of the above Paragraph 3), the braided wire of the shielded cable is connected to the press-contacting portion or the press-clamping portion, and the spacer separate from the connecting member body is connected to the braided wire, so that a connecting path of the braided wire is formed with a large current-carrying capacity. Therefore, the braided wire, while kept braided around the inner sheath, is electrically connected to the connecting member body without being gathered or twisted.

4) Preferably, the spacer is arranged between the inner sheath and the braided wire of the shielded cable. The spacer is electrically connected to the connecting portion through the braided wire.

In the invention of the above Paragraph 4), the spacer can be connected to the braided wire merely by inserting the spacer between the inner sheath and the braided wire, and therefore the operation for connecting the spacer to the braided wire can be carried out easily, so that the operation efficiency can be further enhanced. In this case, preferably, the spacer is so shaped as to be easily inserted between the inner sheath and the braided wire.

5) Preferably, the connecting member is electrically connected to the shielded cable and a grounding wire.

In the invention of the above Paragraph 5), when the shielded cable is to be connected to a grounding circuit, for example, another wire serving as the grounding wire is beforehand grounded, and by doing so, the shielded cable can be easily grounded via the spacer.

The shielded cable connecting structures of the present invention can solve problems that the operation efficiency is not good because of the need for the gathering or twisting operation and that the reliability against a disturbance is low, and therefore there can be achieved advantages that the good operation efficiency can be achieved and that the grounding path of the braided wire can be positively secured.

BRIEF DESCRIPTION OF THE DRAWINGS

The above objects and advantages of the present invention will become more apparent by describing in detail preferred exemplary embodiments thereof with reference to the accompanying drawings, wherein:

FIG. **1** is a perspective view of a shielded cable connecting jig used in a first embodiment of a shielded cable connecting structure of the present invention, showing its appearance;

FIG. **2** is a partly-broken, front-elevational view showing a condition in which a shielded cable is connected to the shielded cable connecting jig of FIG. **1**;

FIG. **3** is a cross-sectional view around the shielded cable of FIG. **2**;

FIG. **4** is a perspective view of a shielded cable connecting jig used in a second embodiment of a shielded cable connecting structure of the invention, showing its appearance;

FIG. **5** is a partly-broken, front-elevational view showing a condition in which a shielded cable is connected to the shielded cable connecting jig of FIG. **4**;

FIG. **6** is a cross-sectional view around the shielded cable of FIG. **5**;

FIG. **7** is a perspective view of a shielded cable connecting jig used in a third embodiment of the shielded cable connecting structure of the invention, showing its appearance;

FIG. **8** is a perspective view showing the manner of connecting a shielded cable to the shielded cable connecting jig of FIG. **7**;

FIG. **9** is a perspective view showing a condition in which the shielded cable is connected to the connecting jig of FIG. **8**;

FIG. **10** is a cross-sectional view around the shielded cable of FIG. **9**;

FIG. **11** is a perspective view showing the manner of connecting a shielded cable to a shielded cable connecting jig used in a fourth embodiment of a shielded cable connecting structure of the invention;

FIG. **12** is a perspective view showing a condition in which the shielded cable is connected to the connecting jig of FIG. **11**;

FIG. **13** is a cross-sectional view around the shielded cable of FIG. **12**;

FIG. **14** is a perspective view showing the relation between a shielded cable and a press clamping-type shielded cable connecting jig used in a fifth embodiment of a shielded cable connecting structure of the invention;

FIG. **15** is a perspective view showing a condition in which the connecting jig of FIG. **14** is press-clamped to the shielded cable;

FIG. **16** is a cross-sectional view around the shielded cable of FIG. **15**; and

FIG. **17** is a view showing a related shielded cable connecting structure, showing its appearance.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Preferred embodiments of the present invention will now be described in detail with reference to the drawings.

First Embodiment

First, a first embodiment of a shielded cable connecting structure of the invention will be described with reference to FIGS. **1** to **3**. FIG. **1** is a perspective view of a shielded cable connecting jig used in the first embodiment of the shielded cable connecting structure of the invention, showing its appearance, FIG. **2** is a partly-broken, front-elevational view showing a condition in which a shielded cable is connected to the shielded cable connecting jig of FIG. **1**, and FIG. **3** is a cross-sectional view around the shielded cable of FIG. **2**.

As shown in FIG. **1**, the shielded cable connecting jig **10**, used in the first embodiment of the shielded cable connecting structure of the invention, includes a connecting member body **11** having a bottom plate **12**, a pair of press-fastening portions **13** and **13** formed on and extending upwardly respectively from opposite side edges of the bottom plate **12** at one end portion of the connecting member body **11**, a pair of press-contacting portions **14** and **14** formed at a central portion of the connecting member body **11**, and a spacer **15** formed integrally at the other end of the connecting member body **11**. This connecting jig **10** is made of an ordinary terminal material, that is, electrically-conductive metal such as brass or iron which can not be easily deteriorated by heat.

The shielded cable **60** (see FIG. **2**) is inserted between the pair of press-fastening portions **13** and **13**, and then these press-fastening portions **13** and **13** are press-deformed inwardly, that is, press-fastened onto an outer periphery of an outer sheath **61** (see FIG. **2**) of the shielded cable **60**, so that the shielded cable **60** is held by the shielded cable connecting jig **10**.

A central portion of the bottom plate **12** is bent to provide a pair of closely opposed plate portions **16** and **16**, and an upwardly-open slot or opening is formed in a central portion of each plate portion **16**, and opposed side edges of this slot define a pair of opposed press-contacting blades (also designated respectively by reference numerals **14** for convenience' sake) of the press-contacting portion **14**, respectively. Each press-contacting portion **14** is continuous with a first insertion guide portion **17** (defined by slanting surfaces also designated respectively by reference numerals **17** for convenience' sake) formed at an upper end of the press-contacting portion **14**. Each of the plate portions **16** and **16** has a spacer support portion **18** (in the form of a concavely-curved surface) disposed centrally of a width of the press-contacting portion **14**.

The spacer **15** includes an arm portion **19** formed at and extending upwardly from the other end of the bottom plate **12**, and an insertion plate portion **20** formed at a distal end of the arm portion **19** and curved into a generally C-shape. An outer peripheral surface of the insertion plate portion **20** serves as a braided wire connecting portion **21**. The spacer **15** is formed into such a shape that the insertion plate portion **20** can be easily inserted between each inner sheath **62** (see FIG. **2**) and a braided wire **63** (see FIG. **2**) of the shielded cable **60**.

Before the spacer **15** is used, the arm portion **19** projects upwardly (in FIG. **1**), and the shielded cable **60** is pressed to be moved toward the insertion plate portion **20** from the upper side, so that the insertion plate portion **20** is inserted into the interior of the braided wire **63** at a generally inner peripheral portion of the outer sheath **61**, and is disposed in contiguous relation to an inner peripheral surface of the braided wire **63**. Then, the upwardly-extending arm portion **19** is bent or turned left (i.e., counterclockwise in FIG. **1**) at its central portion, so that the insertion plate portion **20**, together with the shielded cable **60**, is inserted into the pair of press-contacting portions **14** and **14**.

As shown in FIG. **2**, the shielded cable **60** comprises two signal feeding wires **64** (each including a conductor **65** (see FIG. **3**) and the inner sheath **62** covering the outer periphery of the conductor **65**), the braided wire **63** braided around the two inner sheaths **62**, and the outer sheath **61** covering the outer periphery of the braided wire **63** such that the braided wire **63** is disposed at the generally inner peripheral portion of the outer sheath **61**. The conductor **65** is made of an electri-

cally-conductive material such for example as pure copper (Cu) or tin (Sn)-plated pure copper.

When the shielded cable **60** is pressed to be moved toward the shielded cable connecting jig **10** from the upper side, the insertion plate portion **20** of the spacer **15** is inserted into the interior of the braided wire **63** at the generally inner peripheral portion of the outer sheath **61**, and is disposed in contiguous relation to the inner peripheral surface of the braided wire **63**. Then, the upwardly-extending arm portion **19** is bent or turned left (i.e., counterclockwise in FIG. **2**) at its central portion, so that the shielded cable **60** having the insertion plate portion **20** inserted therein is pressed to be inserted into the pair of press-contacting portions **14** and **14**. As a result, the press-contacting portions **14** and **14** cut the outer sheath **61** of the shielded cable **60**, and are press-contacted with the braided wire **63** to be electrically connected thereto.

When the shielded cable **60** is thus pressed to be inserted into the press-contacting portions **14** and **14**, the outer peripheral surface of the braided wire **63** is electrically connected to the press-contacting portions **14** and **14** with large contact areas, and also the inner peripheral surface of the braided wire **63** is electrically connected to the braided wire connecting portion **21** with a large contact area, as shown in FIG. **3**. As a result, the braided wire **63** is electrically connected to the connecting member body **11** via the press-contacting portions **14** and **14** and the insertion plate portion **20** of the spacer **15** with a large current-carrying capacity.

For forming the shielded cable connecting jig **10**, an electrically-conductive metal sheet having a predetermined thickness is cut into a predetermined developed shape, and then the pair of press-fastening portions **13** and **13**, the pair of plate portions **16** and **16** and the spacer **15** are formed by bending relevant portions of the thus cut sheet relative to the bottom plate **12**. Thus, this method does not include any complicated processing step, and therefore the shielded cable connecting jig **10** can be formed using existing facilities.

When the shielded cable connecting jig **10** is to be used, the shielded cable **60** is pressed to be inserted into the press-contacting portions **14** and **14**, and then the press-fastening portions **13** and **13** are press-fastened to the shielded cable **60** to fix this shielded cable **60**, and the shielded cable connecting jig **10** is electrically connected, for example, to a grounding terminal or a bus bar on a circuit board or a metallic grounding member such as vehicle body panel. As a result, the braided wire connecting portion **21** of the insertion plate portion **20** of the spacer **15** is electrically connected to the inner peripheral surface of the braided wire **63** with the large contact area, and also the press-contacting portions **14** and **14** are electrically connected to the outer peripheral surface of the braided wire **63** with the large contact areas. Therefore, even when a disturbance develops around the shielded cable **60**, disturbance components captured by the braided wire **63** flow through the spacer **15**, that is, flow sequentially through the insertion plate portion **20**, the arm portion **19** and the connecting member body **11**, and also flow sequentially through the press-contacting portions **14** and **14** and the connecting member body **11**. Thus, the disturbance components are positively flowed to a grounding circuit, thereby protecting the conductors **65** of the wires **64** from the disturbance.

As described above, in the shielded cable connecting structure of the first embodiment, when the shielded cable **60** is pressed to be inserted into the press-contacting portions **14** and **14**, the braided wire **63** is connected to the press-contacting portions **14** and **14**, and also the insertion plate portion **20** of the spacer **15** formed integrally with the connecting member body **11** is connected to the braided wire **63**, so that the connecting path of the braided wire **63** is formed with the large current-carrying capacity. Therefore, the braided wire **63**, while kept braided around the inner sheaths **62**, is electrically connected to the connecting member body **11** without being gathered or twisted. Therefore, the good operation efficiency can be achieved, and besides the connecting path of the braided wire can be positively secured.

Furthermore, in the shielded cable connecting structure of the first embodiment, merely by inserting the insertion plate portion **20** of the spacer **15** between the inner sheaths **62** and the braided wire **63**, the spacer **15** can be connected to the braided wire **63**, and therefore the operation for connecting the spacer **15** to the braided wire **63** can be effected more easily, and besides the automated operation can be carried out, so that the operation efficiency can be further enhanced.

Second Embodiment

Next, a second embodiment of a shielded cable connecting structure of the invention will be described with reference to FIGS. **4** to **6**. FIG. **4** is a perspective view of a shielded cable connecting jig used in the second embodiment of the shielded cable connecting structure of the invention, showing its appearance, FIG. **5** is a partly-broken, front-elevational view showing a condition in which a shielded cable is connected to the shielded cable connecting jig of FIG. **4**, and FIG. **6** is a cross-sectional view around the shielded cable of FIG. **5**. In the following embodiments including this second embodiment, those constituent elements identical or similar in function to those of the first embodiment will be designated by identical or like reference numerals, respectively, and detail explanation thereof will be simplified or omitted.

As shown in FIG. **4**, the shielded cable connecting jig **30**, used in the second embodiment of the shielded cable connecting structure of the invention, includes a spacer **31** formed integrally with a connecting member body **11**. The spacer **31** includes a tab-like insertion plate portion **32** formed at a distal end of the spacer **31**. The insertion plate portion **32** is thus formed into a tab-like shape, and therefore can be easily inserted between an inner sheath **62** and a braided wire **63** of the shielded cable **60**. An inner surface of the insertion plate portion **32** serves as a braided wire connecting portion **33**. In this case, each of spacer support portions **18** and **18** is in the form of a flat surface. The other portions are identical in construction to the corresponding portions of the first embodiment.

The shielded cable **60** is moved downward toward the spacer **31** of the shielded cable connecting jig **30** from the upper side, so that the insertion plate portion **32** is inserted between the inner sheath **62** and the braided wire **63** of the shielded cable **60**. When the insertion plate portion **32** is thus inserted between the inner sheath **62** and the braided wire **63** of the shielded cable **60**, the insertion plate portion **32** is electrically connected to the braided wire **63**.

Then, the shielded cable **60** is tilted or turned counterclockwise (in FIG. **4**), so that an arm portion **19** of the spacer **31** is bent at its central portion in accordance with the tilting movement of the shielded cable **60**.

When the tilted shielded cable **60** is pressed to be inserted into press-contacting portions **14** and **14**, the press-contacting portions **14** and **14** cut an outer sheath **61** of the shielded cable **60**, and are press-contacted with the braided wire **63** to be electrically connected thereto, as shown in FIG. **5**.

When the shielded cable **60** is thus pressed to be inserted into the press-contacting portions **14** and **14**, an outer peripheral surface of the braided wire **63** is electrically connected to the press-contacting portions **14** and **14** with large contact areas, and also an inner peripheral surface of the braided wire

63 is electrically connected to the braided wire connecting portion 33 of the insertion plate portion 32 of the spacer 31 with a large contact area. As a result, the braided wire 63 is electrically connected to the connecting member body 11 through the press-contacting portions 14 and 14 and the insertion plate portion 32 of the spacer 31 with a large current-carrying capacity.

In the shielded cable connecting jig 30, the braided wire connecting portion 33 of the insertion plate portion 32 of the spacer 31 is electrically connected to the inner peripheral surface of the braided wire 63 with the large contact area, and also the press-contacting portions 14 and 14 are electrically connected to the outer peripheral surface of the braided wire 63 with the large contact areas. Therefore, even when a disturbance develops around the shielded cable 60, disturbance components captured by the braided wire 63 flow through the spacer 31, that is, flow sequentially through the insertion plate portion 32, the arm portion 19 and the connecting member body 11, and also flow sequentially through the press-contacting portions 14 and 14 and the connecting member body 11. Thus, the disturbance components are positively flowed to a grounding circuit, thereby protecting conductors 65 of wires 64 from the disturbance.

As described above, in the shielded cable connecting structure of the second embodiment, when the shielded cable 60 is pressed to be inserted into the press-contacting portions 14 and 14, the braided wire 63 is connected to the press-contacting portions 14 and 14, and also the insertion plate portion 32 of the spacer 31 formed integrally with the connecting member body 11 is connected to the braided wire 63, so that a connecting path of the braided wire 63 is formed with a large current-carrying capacity. Therefore, the braided wire 63, while kept braided around the inner sheaths 62, is electrically connected to the connecting member body 11 without being gathered or twisted. Therefore, the good operation efficiency can be achieved, and besides the connecting path of the braided wire can be positively secured.

Furthermore, in the shielded cable connecting structure of the second embodiment, merely by inserting the insertion plate portion 32 of the spacer 31 between the inner sheath 62 and the braided wire 63, the spacer 31 can be connected to the braided wire 63, and therefore the operation for connecting the spacer 31 to the braided wire 63 can be effected more easily, and besides the automated operation can be carried out, so that the operation efficiency can be further enhanced.

Third Embodiment

Next, a third embodiment of a shielded cable connecting structure of the invention will be described with reference to FIGS. 7 to 10. FIG. 7 is a perspective view of a shielded cable connecting jig used in the third embodiment of the shielded cable connecting structure of the invention, showing its appearance, FIG. 8 is a perspective view showing the manner of connecting a shielded cable to the shielded cable connecting jig of FIG. 7, FIG. 9 is a perspective view showing a condition in which the shielded cable is connected to the connecting jig of FIG. 8, and FIG. 10 is a cross-sectional view around the shielded cable of FIG. 9.

As shown in FIG. 7, the shielded cable connecting jig 40, used in the third embodiment of the shielded cable connecting structure of the invention, includes a connecting member body 11 having a bottom plate 12, and a pair of press-fastening portions 13 and 13 formed on and extending upwardly respectively from opposite side edges of the bottom plate 12 at one end portion of the connecting member body 11. The shielded cable connecting jig 40 further includes a pair of press-contacting portions 14 and 14 formed on and extending upwardly respectively from the opposite side edges of the bottom wall 12 at a central portion of the connecting member body 11, a pair of conductor press-fastening portions 41 and 41 formed on and extending upwardly respectively from the opposite side edges of the bottom plate 12 at that portion of the connecting member body 11 disposed adjacent to the other end portion thereof, and a pair of grounding wire press-fastening portions 42 and 42 formed on and extending upwardly respectively from the opposite side edges of the bottom plate 12 at the other end portion of the connecting member body 11. The shielded cable connecting jig 40 is provided with a separate spacer 43 (see FIG. 8). This shielded cable connecting jig 40 is used for the shielded cable 60 containing two wires 64 and 64, and a grounding wire (another wire) 70 (see FIG. 8) is connected to this connecting jig 40.

A pair of opposed side plates 44 and 44 extend upwardly respectively from the opposite side edges of the bottom plate 12, and opposite end portions of each side plate 44 spaced from each other in the direction of the length of the bottom plate 12 are bent inwardly to form press-contacting blades (which are also designated respectively by reference numerals 14 and 14 for convenience' sake), respectively, and the opposed press-contacting blades (14 and 14) of the two side plates 44 and 44 at their one end portions define one press-contacting portion 14, while the opposed press-contacting blades (14. 14) of the two side plates 44 and 44 at their other end portions define the other press-contacting portion 14.

A conductor 71 of the grounding wire 70 is inserted between the conductor press-fastening portions 41 and 41, and then these press-fastening portions 41 and 41 are press-fastened to the conductor 71, thereby electrically connecting the conductor 71 to the shielded cable connecting jig 40.

The grounding wire 70 is inserted between the grounding wire press-fastening portions 42 and 42, and then these press-fastening portions 42 and 42 are press-fastened to the grounding wire 70 in surrounding relation thereto, thereby fixing the grounding wire 70 to the shielded cable connecting jig 40.

As shown in FIG. 8, the spacer 43 is made of an ordinary terminal material, that is, electrically-conductive metal such as brass or iron which can not be easily deteriorated by heat. This spacer 43 includes a pair of upper and lower wire support surfaces 46 and 46 of a concave shape facing away from each other, and a pair of braided wire connecting portions 47 and 47 formed at opposite sides of the wire support surfaces 46 and 46. Each of the wire support surfaces 47 and 47 has a concave shape similar to an outer shape of a braided wire 63 of the shielded cable 60. A length L1 of the spacer 43 is slightly larger than the distance L2 between the pair of press-contacting portions 14 and 14 spaced from each other in the direction of the length of the bottom plate 12. A width L3 of the spacer 43 is slightly smaller than the distance (or gap) L4 between the opposed press-contacting blades (14 and 14) of each press-contacting portion 14. The spacer 43 is made of the ordinary terminal material, that is, the electrically-conductive metal such as brass or iron which can not be easily deteriorated by heat, and therefore this spacer 43 has a large current-carrying capacity and a predetermined impedance.

The grounding wire 70 has the conductor 71 provided within a sheath 72, and this grounding wire 70 is electrically connected, for example, to a metallic part such as a vehicle body panel in order to form a grounding circuit for an electrical equipment or the like including a resin-made casing.

For assembling the connecting structure, first, the conductor 71 of the grounding wire 70 is inserted between the pair of conductor press-fastening portions 41 and 41, and then these

press-fastening portions **41** and **41** are press-fastened to the conductor **71**, thereby electrically connecting the conductor to the connecting member body **11**. Also, the sheath **72** of the grounding wire **70** is inserted between the pair of grounding wire press-fastening portions **42** and **42**, and then these press-fastening portions **42** and **42** are press-fastened to the sheath **72**, thereby fixing the grounding wire **70** to the shielded cable connecting jig **40**.

Then, the spacer **43** is inserted into the braided wire **63**, braided around the two wires **64** and **64**, from a cut end of the shielded cable **60**, and is disposed between the two wires **64** and **64**. At this time, the spacer **43** is inserted into a position where the spacer **43**, contacting the wires **64** and **64**, is to be pressed contacted with the press-contacting portions **14** and **14** through the braided wire **63**.

Then, the shielded cable **60** having the spacer **43** inserted therein is pressed to be inserted into the pair of press-contacting portions **14** and **14**.

When the shielded cable **60** having the spacer **43** inserted therein is thus pressed to be inserted into the pair of press-contacting portions **14** and **14**, the press-contacting portions **14** and **14** cut an outer sheath **61** of the shielded cable **60**, and are press-contacted with the braided wire **63** to be electrically connected thereto, as shown in FIG. **9**. Then, the press-fastening portions **13** and **13** are press-fastened to the shielded cable **60**, thereby fixing the shielded cable **60** to the shielded cable connecting jig **40**.

In the shielded cable connecting jig **40**, the braided wire connecting portions **47** and **47** (formed respectively at the opposite side surfaces of the spacer **43**) of the spacer **43** inserted in the press-contacting portions **14** and **14** (that is, inserted between the opposed press-contacting blades (**14** and **14**) of each press-contacting portion **14**) are electrically connected to the press-contacting portions **14** and **14** with large contact areas, with the braided wire **63** held between each braided wire connecting portion **47** and the corresponding press-contacting blades (**14**). Therefore, even when a disturbance develops around the shielded cable **60**, disturbance components captured by the braided wire **63** positively flow from the press-contacting portions **14** and **14** to the grounding wire **70** through the spacer **43**, thereby protecting conductors **65** and **65** of the wires **64** and **64** from the disturbance.

As described above, in the shielded cable connecting structure of the third embodiment, when the shielded cable **60** is pressed to be inserted into the press-contacting portions **14** and **14**, the braided wire **63** is connected to the press-contacting portions **14** and **14**, and also the spacer **43** separate from the connecting member body **11** is connected to the braided wire **63**, so that a connecting path of the braided wire **63** is formed with a large current-carrying capacity. Therefore, the braided wire **63**, while kept braided around the inner sheaths **62**, is electrically connected to the connecting member body **11** without being gathered or twisted.

Furthermore, in the shielded cable connecting structure of the third embodiment, when connecting the shielded cable **60** to the grounding circuit, the shielded cable **60** can be easily grounded via the spacer **43** by grounding the grounding wire **70**.

Furthermore, in the shielded cable connecting structure of the third embodiment, the braided wire **63** is gripped by the spacer **43** and the press-contacting portions **14** and **14** (that is, the braided wire **63** is held between the spacer **43** and each press-contacting blade (**14**)), and therefore is much less liable to be affected by a heat change, and therefore the stable connected condition can be maintained for a long period of time, so that the reliability can be enhanced.

Furthermore, in the shielded cable connecting structure of the third embodiment, in the case where the grounding wire **70** is beforehand connected to the shielded cable connecting jig **40**, and the connecting jig **40** is delivered in this form, it is not necessary to effect a stock control of grounding wires **70** as by assigning a product number, different from those of other wire harnesses, to the grounding wires **70**, and therefore the control of the product numbers can be simplified, so that the productivity can be enhanced.

Fourth Embodiment

Next, a fourth embodiment of a shielded cable connecting structure of the invention will be described with reference to FIGS. **11** to **13**. FIG. **11** is a perspective view showing the manner of connecting a shielded cable to a shielded cable connecting jig used in the fourth embodiment of the shielded cable connecting structure of the invention, FIG. **12** is a perspective view showing a condition in which the shielded cable is connected to the connecting jig of FIG. **11**, and FIG. **13** is a cross-sectional view around the shielded cable of FIG. **12**.

As shown in FIG. **11**, the shielded cable connecting jig **50**, used in the fourth embodiment of the shielded cable connecting structure of the invention, includes a spacer **51** of a U-shape. The other portions are identical in construction to the corresponding portions of the third embodiment.

The spacer **51** is upwardly open, and its outer surface defines a braided wire connecting portion **52** (in the form of a convex surface) similar to a shape of the inner side of a braided wire **63** of the shielded cable **60**, and its outer surface defines a wire support surface **53**. The spacer **51** has the U-shape, and therefore is suitably used for connecting the shielded cable containing a plurality of (that is, two or more) wires **64**.

The spacer **51** is inserted into the interior of the braided wire **63** from a cut end of the shielded cable **60**. At this time, the spacer **51** is inserted into a position where the spacer **51**, contacting the wires **64** and **64**, is to be pressed contacted with press-contacting portions **14** and **14** through the braided wire **63**.

As shown in FIG. **12**, the wires **64** and **64** of the shielded cable **60** (having the spacer **51** inserted therein and including the braided wire **63** braided around the wires **64** and **64**) are pressed to be inserted into the press-contacting portions **14** and **14**, and press-fastening portions **13** and **13** are press-fastened to the shielded cable **60**, thereby fixing the shielded cable **60** to the shielded cable connecting jig **50**.

The shielded cable **60** having the spacer **43** inserted therein is pressed to be inserted into the pair of press-contacting portions **14** and **14**, so that the press-contacting portions **14** and **14** cut an outer sheath **61** of the shielded cable **60**, and are press-contacted with the braided wire **63** to be electrically connected thereto, as shown in FIG. **13**.

In the shielded cable connecting jig **50**, the braided wire connecting portion **52** of the spacer **51**, inserted in the press-contacting portions **14** and **14** (that is, inserted between opposed press-contacting blades (**14** and **14**) of each press-contacting portion **14**), is electrically connected at its opposite side surfaces to the press-contacting portions **14** and **14** with large contact areas, with the braided wire **63** held between the braided wire connecting portion **52** and the press-contacting blades (**14**). Therefore, even when a disturbance develops around the shielded cable **60**, disturbance components captured by the braided wire **63** positively flow from the press-contacting portions **14** and **14** to a grounding

wire **70** through the spacer **51**, thereby protecting conductors **65** and **65** of the wires **64** and **64** from the disturbance.

As described above, in the shielded cable connecting structure of the fourth embodiment, when the shielded cable **60** is pressed to be inserted into the press-contacting portions **14** and **14**, the braided wire **63** is connected to the press-contacting portions **14** and **14**, and also the spacer **51** separate from the connecting member body **11** is connected to the braided wire **63**, so that a connecting path of the braided wire **63** is formed with a large current-carrying capacity. Therefore, the braided wire **63**, while kept braided around the inner sheaths **62**, is electrically connected to the connecting member body **11** without being gathered or twisted.

Furthermore, in the shielded cable connecting structure of the fourth embodiment, when connecting the shielded cable **60** to the grounding circuit, the shielded cable **60** can be easily grounded via the spacer **43** by grounding the grounding wire **70**.

Fifth Embodiment

Next, a fifth embodiment of a shielded cable connecting structure of the invention will be described with reference to FIGS. **14** to **16**. FIG. **14** is a perspective view showing the relation between a shielded cable and a press clamping-type shielded cable connecting jig used in the fifth embodiment of the shielded cable connecting structure of the invention, FIG. **15** is a perspective view showing a condition in which the connecting jig of FIG. **14** is press-clamped to the shielded cable, and FIG. **16** is a cross-sectional view around the shielded cable of FIG. **15**.

As shown in FIG. **14**, the shielded cable connecting jig **80**, used in the fifth embodiment of the shielded cable connecting structure of the invention, includes a spacer **51** of a U-shape similar to the spacer **51** used in the above fourth embodiment. The shielded cable connecting jig **80** includes a connecting member body **100** having a bottom plate **102**, a pair of braided wire press-fastening portions (press-clamping portions) **103** and **13** formed on and extending upwardly respectively from opposite side edges of the bottom plate **102**, and a pair of sheath press-fastening portions **104** and **104** formed on and extending upwardly respectively from the opposite side edges of the bottom plate **102** at a central portion of the connecting member body **100**. The other portions are similar in construction to the corresponding portions of the above embodiment, and therefore will be designated respectively by identical reference numerals, and explanation thereof will be omitted. In this embodiment, although the spacer **51** is separate from the connecting member body **100**, it can be formed integrally with the connecting member body **100** as in the first and second embodiments.

An outer sheath **61** is removed over a predetermined length from an end portion of the shielded cable **60**, and the spacer **51** is inserted into the interior of a braided wire **63** at the sheath-removed end portion of the shielded cable **60**. At this time, the spacer **51** is inserted into a position where the spacer **51**, interposed between the exposed braided wire **63** and two wires **64** and **64**, is to be press-clamped by the braided wire press-fastening portions **103** and **103**.

As shown in FIG. **15**, the shielded cable **60** is press-clamped by the braided wire press-fastening portions **103** and **103**, with the braided wire **63** braided around the wires **64** and **64**, and the sheath press-fastening portions **104** and **104** are press-fastened to the outer periphery of the outer sheath **61**, thereby fixing the shielded cable **60** to the shielded cable connecting jig **80**.

As shown in FIG. **16**, the braided wire press-fastening portions **103** and **103** are press-clamped to the braided wire **63** (braided around the wires **64** and **64**) at the end portion of the shielded cable **60** (in which the spacer **51** is inserted), and therefore are electrically connected to this braided wire **63**.

In the shielded cable connecting jig **80**, the braided wire press-fastening portions **103** and **103** are press-clamped to the outer periphery of the braided wire **63**, with the inserted spacer **51** held between the braided wire **63** and inner sheaths **62** of the wires **64**, and therefore the braided wire press-fastening portions **103** and **130** are electrically connected to the braided wire **63** with large contact areas. Therefore, even when a disturbance develops around the shielded cable **60**, disturbance components captured by the braided wire **63** positively flow from the braided wire press-fastening portions **103** and **103** to a grounding wire **70** through the spacer **51**, thereby protecting conductors **65** and **65** of the wires **64** and **64** from the disturbance.

As described above, in the shielded cable connecting structure of the fifth embodiment, the spacer **51** is pressed to be inserted into the gap between the exposed braided wire **63** and the wires **64** and **64** at the sheath-removed end portion of the shielded cable **60**, and the braided wire press-fastening portions **103** and **103** are press-clamped to the outer periphery of the exposed braided wire **63**. As a result, the braided wire press-fastening portions **103** and **103** are electrically connected to the braided wire **63** with the large contact areas, so that a connecting path of the braided wire **63** is formed with a large current-carrying capacity. Therefore, the braided wire **63**, while kept braided around the inner sheaths **62**, is electrically connected to the connecting member body **100** without being gathered or twisted.

The invention is not limited to the above embodiments, and suitable modifications, improvement and so on can be made. For example, the shape of the press-contacting portions is given merely as one example, and is not limited to any specified shape, and one press-contacting portion (including the pair of opposed press-contacting blades) may be provided, or more than two press-contacting portions may be provided in a consecutive manner.

Although the invention has been illustrated and described for the particular preferred embodiments, it is apparent to a person skilled in the art that various changes and modifications can be made on the basis of the teachings of the invention. It is apparent that such changes and modifications are within the spirit, scope, and intention of the invention as defined by the appended claims.

The present application is based on Japan Patent Application No. 2006-042734 filed on Feb. 20, 2006, the contents of which are incorporated herein for reference.

What is claimed is:

1. A shielded cable connecting structure for connecting a shielded cable, the shielded cable including an electric wire portion which has a conductor and an inner sheath covering the conductor, a braided wire braided around the inner sheath, and an outer sheath covering the braided wire, the shielded cable connecting structure comprising:

a connecting member that includes:

a connecting main body;

a press-fastening portion for fastening at least part of the shielded cable;

a connecting portion including a pair of press-contacting portions and a spacer supporting portion, and defining a space thereamong in which the shield cable is received, the press-contacting portions cutting the outer sheath and contacting the braided wire upon insertion of the shielded cable in the space; and

a spacer for contacting the braided wire,

wherein the spacer is arranged between supporting portion and the shielded cable inserted in the space; and

wherein the spacer increases a contact pressure of the braided wire with the connecting portion.

2. The shielded cable connecting structure according to claim **1**, wherein the connecting portion is a press-contacting portion or a press-clamping portion.

3. The shielded cable connecting structure according to claim **1**, wherein the spacer is formed at a part of the connecting main body.

4. The sheilded cable connecting structure according to claim **1**, wherein the spacer is separate from the connecting main body.

5. The shielded cable connecting structure according to claim **1**, wherein the spacer is received between the inner sheath and the braided wire of the shielded cable; and

wherein the spacer is electrically connected to the connecting portion through the braided wire.

6. The shielded cable connecting structure according to claim **1**, wherein the connecting member is electrically connected to the sheilded cable and a grounding wire.

* * * * *